Chapter 6.7 ESTUARY AND COASTAL PROGRAM INITIATIVES AND ASSESSMENT

The Commonwealth of Virginia has 120 miles of Atlantic Ocean coastline and approximately 2,200 square miles of estuary. This resource has a prominent place in Virginia's history and culture. It is valued for its commercial fishing, wildlife, sporting, and recreational opportunities, as well as its commercial values in shipping and industry. In the late 1970's, adverse trends in water quality and living resources were noted and prompted creation of the Federal-Interstate Chesapeake Bay Program (CBP).

Through participation in the CBP and implementation of special state initiatives, Virginia maintains a firm commitment to rehabilitate and wisely manage its estuarine resources. Because nearly all of Virginia's estuarine waters flow into the Chesapeake Bay, the activities of the CBP apply to Virginia's estuaries in general. This chapter provides an overview of the state's initiatives intended to restore and preserve the Chesapeake Bay and its tidal tributaries as well as the results of the 2006 assessment of designated uses.

Federal - Interstate Chesapeake Bay Program

In 1983, Virginia, Maryland, Pennsylvania, the District of Columbia, the Environmental Protection Agency, and the Chesapeake Bay Commission formally agreed, by signing a Chesapeake Bay Agreement, to undertake the restoration and protection of the Bay using a cooperative Chesapeake Bay Program approach. This approach established specific mechanisms for its coordination among the Program participants.

Recognizing the need for an expanded and refined commitment to the Bay's restoration, a new Bay Agreement was signed in 1987. The new agreement contained goals and priority commitments in six areas: Living Resources; Water Quality; Population Growth and Development; Public Information, Education, and Participation; Public Access; and Governance. A key Water Quality goal established by the 1987 Agreement was to reduce, by the year 2000, the annual nutrient load of nitrogen and phosphorus entering the Bay from controllable sources by 40%. The starting point, or "baseline", for this reduction effort was the sum total of 1985 point source loads (discharges from significant municipal and industrial treatment plants) and non-point source loads (runoff from agricultural, forested and urban areas) in an average rainfall year. Achieving this 40% reduction was expected to improve dissolved oxygen levels and water clarity conditions in the Bay, which in turn would help improve the habitats and health of living resources.

In 1992, the nutrient reduction goal was reevaluated using information from a variety of sources, most notably water quality monitoring and modeling programs. As a result, the Bay Program reaffirmed its commitment to the 40% goal in a set of 1992 Amendments to the Bay Agreement. The Amendments also directed that tributary-specific nutrient reduction strategies be developed to achieve and maintain the goal, as well as to protect and improve aquatic habitats within those rivers.

On June 28, 2000, the Chesapeake Executive Council signed Chesapeake 2000 – a new and far-reaching agreement that has been guiding Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission, and the U.S. Environmental Protection Agency (EPA) in their combined efforts to restore and protect the Chesapeake Bay. Chesapeake 2000 outlines 93 commitments detailing protection and restoration goals critical to the health of the Bay watershed. From pledges to increase riparian forest buffers, preserve additional tracts of land, restore oyster populations and protect wetlands, Chesapeake 2000 strives toward improving water quality as it is the most critical element in the overall protection and restoration of the Bay and its tributaries.

At the same time Bay Program partners were developing the new Bay Agreement, the Chesapeake Bay and many of its tidal tributaries were placed on the "impaired waters" list. This action is normally followed by the development of a "total daily maximum load" (TMDL) through a regulatory process. Chesapeake 2000 seeks to avoid regulatory approaches by achieving water quality improvements prior to the timeframe when a Baywide TMDL would need to be established. To accomplish this goal, Chesapeake Bay Program developed a new process for setting and achieving nutrients and sediment load reductions necessary to restore Bay water quality. In this process Bay Program partners built on previous nitrogen and phosphorus reduction efforts, but instead of measuring improvement against broad 1997 40% reduction goals, they established specific water quality conditions to be met. This new process incorporates elements traditionally found in the regulatory TMDL process, such as water quality criteria, and load allocations, but also was developed and applied through a cooperative process involving six states, the District of Columbia, local governments and involved citizens. For the first time, Delaware, New York and West Virginia are formally partnering with EPA, the Bay states and the District to improve water quality watershed-wide.

In Virginia, the Department of Environmental Quality (DEQ) has primary responsibility for point source discharge issues, bringing together programs in the areas of surface and groundwater protection, waste management, and air pollution control. The Department of Conservation and Recreation (DCR) has the lead for nonpoint source control programs. Other state agencies that provide vital support include: Game and Inland Fisheries, Forestry, Health, Marine Resources Commission, Agriculture and Consumer Services, along with higher education units Virginia Institute of Marine Science and Old Dominion University.

Tributary Strategy Program

Tributary strategy plans are water quality plans cooperatively developed with stakeholders in each river basin. Agencies under the Secretary of Natural Resources worked closely with local governments, Planning District Commissions, Soil and Water Conservation Districts, sanitation and wastewater authorities, conservation and river-user groups, agricultural producers, industries, and others to develop strategies that are practical and can be implemented. Reducing nutrient and sediment loads to receiving waters through the implementation of tributary strategies are a high priority for Virginia. Through the previous tributary strategy program (which used a voluntary, cooperative approach), substantial resources were dedicated to this effort and significant point source progress already was achieved in the Shenandoah-Potomac River basin. Previous tributary strategy plans implemented for the remaining basins did not show quite as impressive reductions in nutrients (due in part to limited funding opportunities).

In March 2003, Virginia replaced the 40% reduction goals and agreed to new annual load allocations for nitrogen and phosphorus and for the first time developed allocations for sediment loading. These allocations –combined for the five basins - set a goal of 51.4 million pounds/yr for nitrogen, 6 million pounds/yr for phosphorus and 1.9 million pounds/yr for sediments. In April 2004, the Secretary of Natural Resources released draft revised Strategies for public review and comment. The waste load allocations for point sources were determined in accordance with the guiding principals of the Secretary's Policy Statement -- a combination of existing design capacity in conjunction with currently available and stringent treatment technologies. The latest developments and most recent documents can be found at the following link: http://www.naturalresources.virginia.gov/Initiatives/VirginiaWaterQuality/index.cfm.

Based on the public comments received and a policy statement issued by the Secretary on August 27, 2004, the point source elements of the Strategies were further revised; such that the revised control levels in the Strategies now have a direct relationship to proposed regulatory requirements. These requirements are covered under Regulation 9VAC25-40: "Regulation for Nutrient Enriched Waters and Dischargers within the Chesapeake Bay Watershed" (which includes specific concentration limits) and annual waste load allocations proposed under Regulation 9VAC25-720: "Water Quality Management Planning Regulation". Implementation of nutrient reduction technology at the Publicly Owned Treatment Works shown in these Regulations is eligible for state-cost share through the Water Quality Improvement Fund program.

Point Source Tributary Strategy Plans for Nutrient Reduction

Individual waste load allocations for point sources were determined in accordance with the guiding principals of the Secretary's August 2004 Policy Statement -- a combination of existing design capacity in conjunction with currently available and stringent treatment technologies. By summing the individual allocations, an aggregate point source allocation for each basin and the entire State can be developed. In September 2005, the State Water Control Board approved allocations for significant point source dischargers in the Shenandoah-Potomac, Rappahannock, and Eastern Shore Basins. Final allocations for the York and James River basins remain interim at the time this report was being prepared; however, the allocations will be tied to the newly adopted water quality criteria for chlorophyll *a* and dissolved oxygen. Using the official information available through the 2003 simulation/model run, point sources (basinwide) have reduced the TN pounds delivered to the Bay by about 31% since 1985 and TP pounds have been reduced by about 52%. As impressive as this may sound, based on the 2003 run and the adopted point source waste load allocations, wastewater plants must reduce TN and TP, respectively, by about an additional 30% and 38% basinwide.

Broken down into individual basins, point sources within the Shenandoah-Potomac must still reduce the delivered TN loads by about 21%; point sources within the Rappahannock must reduce TN loads by 9%; point sources on the Eastern Shore would have to reduce TN loads by about 84%. Based on the interim loads for the York and James, the additional TN percent reduction in pounds delivered is, respectively, is about 25% and 32%.

Broken down into individual basins and for TP, point sources within the Shenandoah-Potomac must still reduce the loads delivered by about 23%; point sources within the Rappahannock must reduce TN loads by 35%; point sources on the Eastern Shore would have to reduce TN loads by about 72%. Based on the interim loads for the York and James, the additional TP percent reduction in pounds delivered is, respectively, is about 45% and 30%.

Previous Water Quality Improvement Fund grants have provided about $105 million to local governments thru the cost share program for the design and installation of nutrient reduction technology. DEQ estimates full implementation of nutrient reduction technology to achieve the tributary strategy loads and concentrations consistent with the two regulations could cost approximately $1.4 billion.

Nonpoint Source Nutrient Reduction Actions in the Tributary Strategy Plans

Basin wide, the nonpoint source reductions call for BMPs installed and maintained on 92 percent of all available agricultural lands, 85 percent of all mixed open lands, and 74 percent on all urban lands. As per the final tributary strategy document at: http://www.naturalresources.virginia.gov/Initiatives/VirginiaWaterQuality/FinalizedTribStrats/ts_statewide_All.pdf. The nonpoint source approach (under the coordination of the Virginia Department of Conservation and Recreation), is to refocus available tools, to steer new resources to Virginia's strongest nonpoint source control programs, and to push them to maximize reductions across the landscape. These efforts will focus on seven programmatic areas:

1) Accelerate Agricultural Best Management Practices (BMP)
2) Expand Nutrient Management Planning and Implementation Efforts
3) Consolidate and Strengthen of the Virginia Stormwater Management Program
4) Enhanced Implementation of the Virginia Erosion and Sediment Control Program
5) Strengthen Implementation of the Chesapeake Bay Preservation Act
6) Enhancement of the NPS Implementation Database Tracking Systems
7) Enhanced outreach, media and education efforts to reduce pollution producing behaviors

Not only is achieving the sediment and nutrient caps important, maintaining the caps - in light of land use changes, population shifts, and wastewater services - becomes paramount in the long run.

Water Quality and Habitat Monitoring Initiatives

Chesapeake Bay Program

Monitoring is vital to understanding environmental problems, developing strategies for managing the Bay's resources, and assessing progress of management practices. The purpose of the Chesapeake Bay Program (CBP) Water Quality and Habitat Monitoring Program is to assess status and trends in water quality and living resources throughout the Virginia portion of the Bay. Parameters monitored include those directly related to Water Quality Standards (e.g. dissolved oxygen, water clarity, chlorophyll *a,* etc…) as well as basic ecological health indicators such as primary productivity, nutrients, phytoplankton species etc… A general description of the Chesapeake Bay monitoring program is:

- Water quality monitoring at 38 fixed stations on the Rappahannock, York and James Rivers;
- Water quality monitoring at 27 fixed stations in the Chesapeake Bay mainstem;
- Water quality monitoring and estimates of nutrient loading at "River input" stations on the James, Appomattox, Mattaponi, Pamunkey, and Rappahannock Rivers;
- Monitoring of phytoplankton communities in the mainstem of the Chesapeake Bay at 7 stations and in the tributaries at 6 stations;

- Monitoring of benthos communities in the Bay and its tributaries at 19 fixed stations and 100 random stations per year;
- Spatially and temporally intensive monitoring of selected water quality parameters in a rotating waterbody basis for 3-year periods.

Estuarine Probabilistic Monitoring Program (Coastal 2000)

A less extensive monitoring program which probabilistically samples VA's estuarine waters (including those outside the bay watershed such as on the Atlantic coast of the eastern Shore) is the "National Coastal Assessment (NCA) Program", formerly known as the "Coastal 2000 Initiative". A detailed discussion of this program is given in Chapter 2.1.

Toxics, Pollution Prevention and Businesses for the Bay Initiative

The 1987 Chesapeake Bay Agreement committed the signatories to develop, adopt and begin implementation of a basin-wide toxics strategy to achieve a reduction of toxics, consistent with the Water Quality Act of 1987, which would ensure protection of human health and living resources. Following the implementation of a multi-jurisdictional effort to define the nature, extent, and magnitude of toxics problems, the initial strategy was further strengthened with the adoption of the 1994 Basin-Wide Toxics Reduction and Prevention Strategy. The primary goal of the 1994 strategy was to have a:

"*Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumlative impact on living resources that inhabit the Bay or on human health".*

Building upon progress achieved through the implementation of the 1994 Strategy, the Chesapeake Bay Program Executive Council adopted a revised strategy in December 2000 known as the "Toxics 2000 Strategy". With the retention of the 1994 goal, new objectives and commitments were developed and incorporated into the document. An important strategy objective is to strive for zero release of chemical contaminants from point and non-point sources through pollution prevention and other voluntary means. For those areas with known chemical contaminant problems referenced as Regions of Concern, such as the Elizabeth River in Southeastern Virginia, the strategy includes commitments leading to their restoration. Finally, the strategy includes commitments that will provide the means to measure progress toward meeting the overall strategy goal. One approach consists of toxics characterization where information derived from concurrent biological and chemical monitoring are synthesized within the context of toxicological impacts.

Pollution prevention (or P2) is a hierarchy of activities and techniques to reduce or eliminate wastes at their source of generation. P2 was embraced by the Chesapeake Bay's Executive Council because many P2 techniques not only decrease chemical discharges and waste generation, but also result in increased production efficiency and reduced waste disposal costs for businesses. For this reason, business and industry have been the leaders in developing many P2 techniques and are proponents of this voluntary approach to eliminating or reducing the generation of wastes.

Working closely with representatives from business and industry, the EPA's Chesapeake Bay Program and the Pollution Prevention programs of the Bay states helped craft *Businesses for the Bay*, a voluntary pollution prevention program designed to encourage business and industry to adopt pollution prevention principles. *Businesses for the Bay* was kicked off in January 1997, and it is the primary business component of the Toxics 2000 Strategy of the Chesapeake 2000 Agreement. More recently, *Businesses for the Bay* broadened its mission in support of the work of the Nutrients Subcommittee, and it is encouraging its membership to also focus on nutrient reductions.

Membership in *Businesses for the Bay* is open to all businesses and other facilities in the Bay watershed, including federal, state, and local government facilities. Each participating facility annually develops its own P2 goals and reports back on its progress of the previous year's efforts. The program also supports a business-to-business mentoring program, and individual "experts" from member facilities have volunteered to provide assistance to others. Members not only benefit from cost savings and increased efficiencies, but also from positive publicity, increased patronage, access to mentoring services, and eligibility for annual awards from the Executive Council.

To date, there are more than 698 participants and 125 mentors in Businesses for the Bay. Virginia accounts for 302 *Businesses for the Bay* members and 54 of its mentors. In 2004, Virginia participants reported approximately 115 million pounds of waste reduction and recycling, and over $3.8 million in cost savings due to pollution prevention efforts.

The Virginia DEQ's Office of Pollution Prevention actively promotes *Businesses for the Bay* through a variety of approaches, including presentations, directed mailings, a website www.deq.virginia.gov/p2/b4b, and site visits to both potential members and member facilities. In support of the efforts of *Businesses for the Bay*, Virginia has pursued partnerships and reciprocal agreements with other P2 initiatives, such as the Virginia Environmental Excellence Program, the Elizabeth River Project, the Virginia Clean Marinas Program, and the DEQ/Department of Defense P2 Partnership.

Voluntary Restoration Awards

Each year, the Council recognizes businesses and other entities that have made significant voluntary achievements in pollution prevention and served as leaders in the Bay's restoration efforts. In 2005, the Executive Council presented 18 awards in various categories, and Virginia entities received 16 of those awards. The following awards were presented to Virginia entities:

- Outstanding Achievement for a Government Facility - State Government Christopher Newport University, Grounds Department
- Outstanding Achievement for a Government Facility - State Government Commander, Navy Region, Mid-Atlantic
- Outstanding Achievement for a Government Facility - Federal Government Fort Lee, U.S. Army
- Outstanding Achievement for a Government Facility - Federal Government Fort Monroe, U.S. Army
- Outstanding Achievement for a Government Facility - Local Government Hopewell Regional Wastewater Treatment
- Outstanding Achievement for a Government Facility - Local Government Fairfax County Government -- Dept. of Vehicle Services
- Outstanding Achievement for Nutrient Reduction Fairfax County Wastewater Management Program
- Outstanding Achievement for Pollution Prevention - Large Facility Waste Management of Virginia, Maplewood Recycling
- Outstanding Achievement for Pollution Prevention - Large Facility Smithfield Transportation
- Outstanding Achievement for Pollution Prevention - Medium-Sized Facility Ukrop's Food Group
- Outstanding Achievement for Pollution Prevention - Small Facility Citgo Petroleum
- Outstanding Achievement for Toxics Reduction Infineon Technologies
- Partner of the Year ERG
- Partner of the Year Esquire Environmental Services, Inc.
- Mentor of the Year Pam Boatwright, Elizabeth River Project
- Mentor of the Year Jimmy Parrish, Defense Logistics Center Richmond

For more information, please access the Businesses for the Bay website at www.b4b.org. You may also contact VA DEQ's Keith Boisvert at 804-698-4225 or kaboisvert@deq.virginia.gov; or you may contact the Businesses for the Bay Coordinator Marylynn Wilhere at 1-800-YOURBAY or wilhere.marylynn@epa.gov.

Assessment of Aquatic Life Use in Chesapeake Bay and It's Tidal Tributaries

Summary

The assessment process for Chesapeake Bay and its tidal tributaries has undergone major changes for this period in comparison to prior reports. DEQ has adopted new uses and criteria, new analysis tools and statistical protocols for assessment of the criteria, and new 303(d) listing "rules". All of these aspects are quite different than previously used and a departure from that used in other state waters. Many aspects of the new criteria are still under development or revision (e.g. protocols for short term criteria assessment, statistical revisions to protocols used in this 2006 assessment). Because of this, the results of this 2006 assessment are considered transitional and it is possible that future assessments may differ.

One finding of this 2006 assessment is that water quality impairments due to dissolved oxygen levels are not limited to the deeper waters as was previously believed. We found large areas of the Bay mainstem as well as its tributaries (e.g. James, Rappahannock and York Rivers) which have dissolved oxygen impairments in surface waters.

Assessment of the new designated use for Submerged Aquatic Vegetation found that, as expected, the vast majority of Bay waters do not have sufficient levels of this important plant community. Benthic biological communities (e.g. worms, insects) show about the same level of degradation as previous reports though this report used an improved statistical approach.

While not discussed in detail in this chapter on Aquatic Life use, it is worth noting here that the designated use of "Fish Consumption" is impaired throughout the Chesapeake Bay for the first time in this period. This was due to elevated levels of PCB's found in fish tissue. The Virginia Department of Health issued an advisory in 2004 that the consumption of Striped Bass from Chesapeake Bay be limited to no more than 2 meals per month.

The following sections describe 1) Development and Adoption of New Aquatic Life Uses and Criteria, 2) 2006 Chesapeake Bay Aquatic Life Use Assessment Results and 3) Plans for future assessment refinements.

1) Development and Adoption of New Aquatic Life Uses and Criteria

The Chesapeake Bay 2000 agreement signed by the Governor of Virginia committed to, "correct the nutrient and sediment related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters under the Clean Water Act" by 2010 .

The first step in this process was to define appropriate regulatory criteria by which the Bay should be assessed. The U.S. Environmental Protection Agency (EPA) Region III developed a guidance document, entitled "Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and Its Tidal Tributaries (April 2003)". This document proposed nutrient and sediment enrichment criteria expressed as dissolved oxygen, water clarity and chlorophyll a criteria, applicable to the Chesapeake Bay and its tidal tributaries. This document formed the technical basis for adoption by DEQ of new sub-categories of aquatic life use in the Chesapeake Bay and its tidal tributaries.

Previous Virginia water quality required a monthly average 5 mg liter^{-1} of dissolved oxygen throughout all of the Bay's waters – from the deep trench near the Bay's mouth to the shallows at the head of the Bay. Even though the 5 mg liter^{-1} was Bay-wide, natural conditions dictate that in some sections of the Bay, such as the deeper waters, waters naturally could not achieve the current 5 mg liter^{-1} during the warmer months of the year due to inhibition of mixing as a result of salinity and temperature stratification. Additionally, other areas such as prime migratory fish spawning areas require higher than 5 mg/l of dissolved oxygen to sustain life during the late winter to early summer time frame. In short, the amount of oxygen needed in the Bay tidal waters depends on specific needs of the aquatic living resources, where they live, and during which time of the year they live there.

Beyond these necessary changes to dissolved oxygen criteria, Virginia also did not have any regulatory criteria for evaluating water quality effects on submerged aquatic vegetation. Submerged aquatic vegetation provides valuable habitat for other living resources such as juvenile fish as well as ecosystem functions such as nutrient/sediment reductions and shoreline stabilization.

Because of these factors, five new Chesapeake Bay tidal water aquatic life sub-uses were adopted by Virginia to reflect the different aquatic living resource communities in a variety of habitats. The new aquatic life designated use subcategories are described below. It should be noted that the overall State-wide Aquatic Life Use (ALUS) of "propagation and growth of a balanced indigenous population of aquatic life, including game fish" for waters in the Chesapeake Bay still exists as a distinct designated use which is assessed with other protocols including benthic Indices of Biological Integrity (IBI), ammonia criteria, and toxicity bioassays. Furthermore, any non-attainment of these new subcategories of aquatic life use is considered a non-attainment of the overall Aquatic life use.

New Aquatic Life Use Subcategories

Designated Uses

<u>Migratory Fish Spawning and Nursery (MSN) Designated Use:</u> Waters in the Chesapeake Bay and its tidal tributaries that protect the survival, growth and propagation of the early life stages of a balanced, indigenous population of anadromous, semi-anadromous, catadromous and tidal-fresh resident fish species inhabiting spawning and nursery grounds. A generalized depiction of location of this designated use is shown in Figure 6.7-1 and detailed geographic descriptions can be found in "<u>U.S. Environmental Protection Agency. 2004. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum Chesapeake Bay Program Office, Annapolis, Maryland</u>". The designated use extents from the end of tidal waters to the downriver end of spawning and nursery habitats that have been determined through a composite of all targeted anadromous and semi-anadromous fish species' spawning and nursery habitats. The designated use extends horizontally from the shoreline of the body of water to the adjacent shoreline, and extends down through the water column to the bottom water-sediment interface. This use applies February 1 through May 31 and applies in addition to the open-water use.

<u>Shallow-Water Submerged Aquatic Vegetation (SWSAV) Designated Use:</u> Waters in the Chesapeake Bay and its tidal tributaries that support the survival, growth and propagation of submerged aquatic vegetation (rooted, underwater bay grasses). A generalized depiction of location of this designated use is shown in Figure 6.7-1 and detailed geographic descriptions can be found in "<u>U.S. Environmental Protection Agency. 2004. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum Chesapeake Bay Program Office, Annapolis, Maryland</u>". This use applies April 1 through October 31 in tidal-fresh, oligohaline and mesohaline Chesapeake Bay Program segments, and March 1 through November 30 in polyhaline Chesapeake Bay Program segments and applies in addition to the open-water use.

<u>Open-Water (OW) Aquatic Life Designated Use:</u> Waters in the Chesapeake Bay and its tidal tributaries that protect the survival, growth and propagation of a balanced, indigenous population of aquatic life inhabiting open-water habitats. A generalized depiction of location of this designated use is shown in Figure 6.7-1 and detailed geographic descriptions can be found in "<u>U.S. Environmental Protection Agency. 2004. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum Chesapeake Bay Program Office, Annapolis, Maryland</u>". This designated use applies year-round but the vertical boundaries change seasonally. October 1 - May 31, the open water aquatic life use extends horizontally from the shoreline at mean low water, to the adjacent shoreline, and extending through the water column to the bottom water-sediment interface. June 1 - September 30, if a pycnocline (i.e. a physical inhibition of mixing) is present and, in combination with bottom bathymetry and water column circulation patterns, presents a barrier to oxygen replenishment of deeper waters, this designated use extends down into the water column only as far as the upper boundary of the pycnocline. June 1 - September 30, if a pycnocline is present but other physical circulation patterns (such as influx of oxygen rich oceanic bottom waters) provide for oxygen replenishment of deeper waters, the open-water aquatic life designated use extends down into the bottom water-sediment interface. This designated use includes the migratory fish spawning and nursery and shallow-water submerged aquatic vegetation uses.

Deep-Water (DW) Aquatic Life Designated Use: waters in the Chesapeake Bay and its tidal tributaries that protect the survival and growth of a balanced, indigenous population of aquatic life inhabiting deep-water habitats. A generalized depiction of location of this designated use is shown in Figure 6.7-1 and detailed geographic descriptions can be found in "U.S. Environmental Protection Agency. 2004. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum Chesapeake Bay Program Office, Annapolis, Maryland". This designated use extends to the tidally influenced waters located between the upper and lower boundaries of the pycnocline where, in combination with bottom bathymetry and water circulation patterns, a pycnocline is present and presents a barrier to oxygen replenishment of deeper waters. In some areas, the deep-water designated use extends from the upper boundary of the pycnocline down to the bottom water-sediment interface (see boundaries in U.S. Environmental Protection Agency. 2004. *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum.* Chesapeake Bay Program Office, Annapolis, Maryland). This use applies June 1 through September 30.

Deep-Channel (DC) Seasonal Refuge Designated Use: Waters in the Chesapeake Bay and its tidal tributaries that protect the survival of a balanced, indigenous population of benthic infauna and epifauna inhabiting deep-channel habitats. A generalized depiction of location of this designated use is shown in Figure 6.7-1 and detailed geographic descriptions can be found in "U.S. Environmental Protection Agency. 2004. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum Chesapeake Bay Program Office, Annapolis, Maryland". This designated use extends to the tidally influenced waters at depths greater than the lower boundary of the pycnocline in areas where, in combination with bottom bathymetry and water circulation patterns, the pycnocline presents a barrier to oxygen replenishment of deeper waters (see boundaries in U.S. Environmental Protection Agency. 2004. *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 2004 Addendum.* Chesapeake Bay Program Office, Annapolis, Maryland). This use applies June 1 through September 30.

Applicable Criteria

Dissolved oxygen criteria to protect the described uses are shown in Table 6.7-1. The methodology for assessing monitoring data against these criteria is very different than has traditionally been used for this regulatory criteria assessment. It involves a spatial interpolation of fixed site monitoring results to create a 3-D picture of oxygen conditions in thousands of individual grid cells throughout the Bay. Each individual grid cell is then assessed against the criteria. In this way, the volume of water in attainment is calculated for each data collection cruise and a "spatial" assessment achieved. In order to account for naturally induced fluctuations over seasons and years, the individual spatial assessments of a three-year time period are aggregated, creating a "temporal" viewpoint. The final assessment involves examining the cumulative frequency distribution (CFD) of attainment from the aggregated data. In this way, a combined "space-time" assessment is achieved which addresses the frequency and magnitude requirements for water quality assessments. More details of this procedure can be found in guidance manuals from EPA and DEQ ("Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity, and Chlorophyll a for the Chesapeake Bay and It's tidal Tributaries, EPA 903-R-03-002, April 2003" , "Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity, and Chlorophyll a for the Chesapeake Bay and It's tidal Tributaries, 2004 Addendum, October 2004", "Water Quality Assessment Guidance Manual for Y2006: 305(B)/303(D) Integrated Water Quality Report, December, 2005".

Criteria specific to the Shallow Water Submerged Aquatic Vegetation use are shown in Table 6.7-2. There are dual criteria of both "Water Clarity Acres" and "SAV Acres". The SAV Acres criterion is met by having actual aquatic vegetation present as measured by annual aerial photography performed by the Virginia Institute of Marine Science. The Water Clarity Acres criterion is met by having sufficient water clarity present to support the potential for aquatic vegetation to grow (i.e. regardless of whether the submerged aquatic vegetation is actually present). This is because the water may be clear enough to support submerged aquatic vegetation but it may take several years for the areas to be re-populated with the grasses.

Spatial Assessment Units

A general overview of the CBP segmentation scheme which is used for assessment of these new designated uses is shown in Figure 6.7-2. Not every new designated use exists in each segment or necessarily throughout the complete segment in which they exist and details of where each designated use occurs within each of these CBP segments can be found in Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability, 2004 Addendum.

Figure 6.7-1 Conceptualized illustration of location of the five Chesapeake Bay tidal water Designated Use zones.

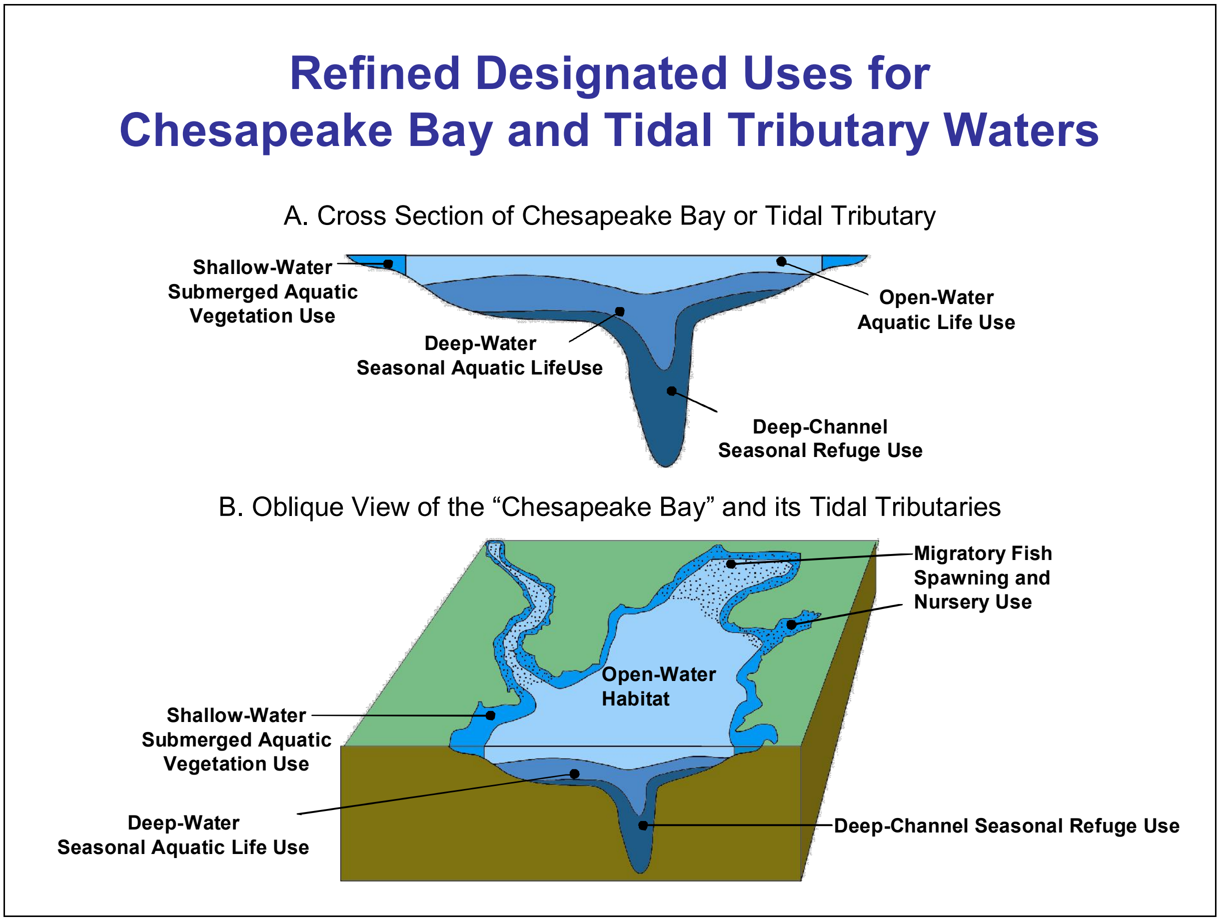


Table 6.7-1. Chesapeake Bay Dissolved Oxygen criteria.

Designated Use	Criteria Concentration/Duration	Protection Provided	Temporal Application
Migratory fish spawning and nursery use	7-day mean ≥ 6 mg liter^{-1} (tidal habitats with 0-0.5 ppt salinity)	Survival/growth of larval/juvenile tidal-fresh resident fish; protective of threatened/endangered species.	February 1 - May 31
	Instantaneous minimum ≥ 5 mg liter^{-1}	Survival and growth of larval/juvenile migratory fish; protective of threatened/endangered species.	
	Open-water fish and shellfish designated use criteria apply		June 1 - January 31
Shallow-water bay grass use	Open-water fish and shellfish designated use criteria apply		Year-round
Open-water fish and shellfish use[1]	30-day mean ≥ 5.5 mg liter^{-1} (tidal habitats with 0-0.5 ppt salinity)	Growth of tidal-fresh juvenile and adult fish; protective of threatened/endangered species.	Year-round
	30-day mean ≥ 5 mg liter^{-1} (tidal habitats with >0.5 ppt salinity)	Growth of larval, juvenile and adult fish and shellfish; protective of threatened/endangered species.	
	7-day mean ≥ 4 mg liter^{-1}	Survival of open-water fish larvae.	
	Instantaneous minimum ≥ 3.2 mg liter^{-1}	Survival of threatened/endangered sturgeon species.[2]	
Deep-water seasonal fish and shellfish use	30-day mean ≥ 3 mg liter^{-1}	Survival and recruitment of bay anchovy eggs and larvae.	June 1 - September 30
	1-day mean ≥ 2.3 mg liter^{-1}	Survival of open-water juvenile and adult fish.	
	Instantaneous minimum ≥ 1.7 mg liter^{-1}	Survival of bay anchovy eggs and larvae.	
	Open-water fish and shellfish designated-use criteria apply		October 1 - May 31
Deep-channel seasonal refuge use	Instantaneous minimum ≥ 1 mg liter^{-1}	Survival of bottom-dwelling worms and clams.	June 1 - September 30
	Open-water fish and shellfish designated use criteria apply		October 1 - May 31

[1]Special criteria for the Mattaponi and Pamunkey rivers are 30 day mean > 4.0 mg/l ;Instantaneous minimum > 3.2 mg/l at temperatures <29^{o}C;Instantaneous minimum > 4.3 mg/l at temperatures > 29^{o}C. These special criteria were not adopted until January 12, 2006 and therefore there was insufficient time to include these in the 2006 assessment.

[2] At temperatures considered stressful to shortnose sturgeon (>29^{o}C), dissolved oxygen concentrations above an instantaneous minimum of 4.3 mg liter^{-1} will protect survival of this listed sturgeon species.

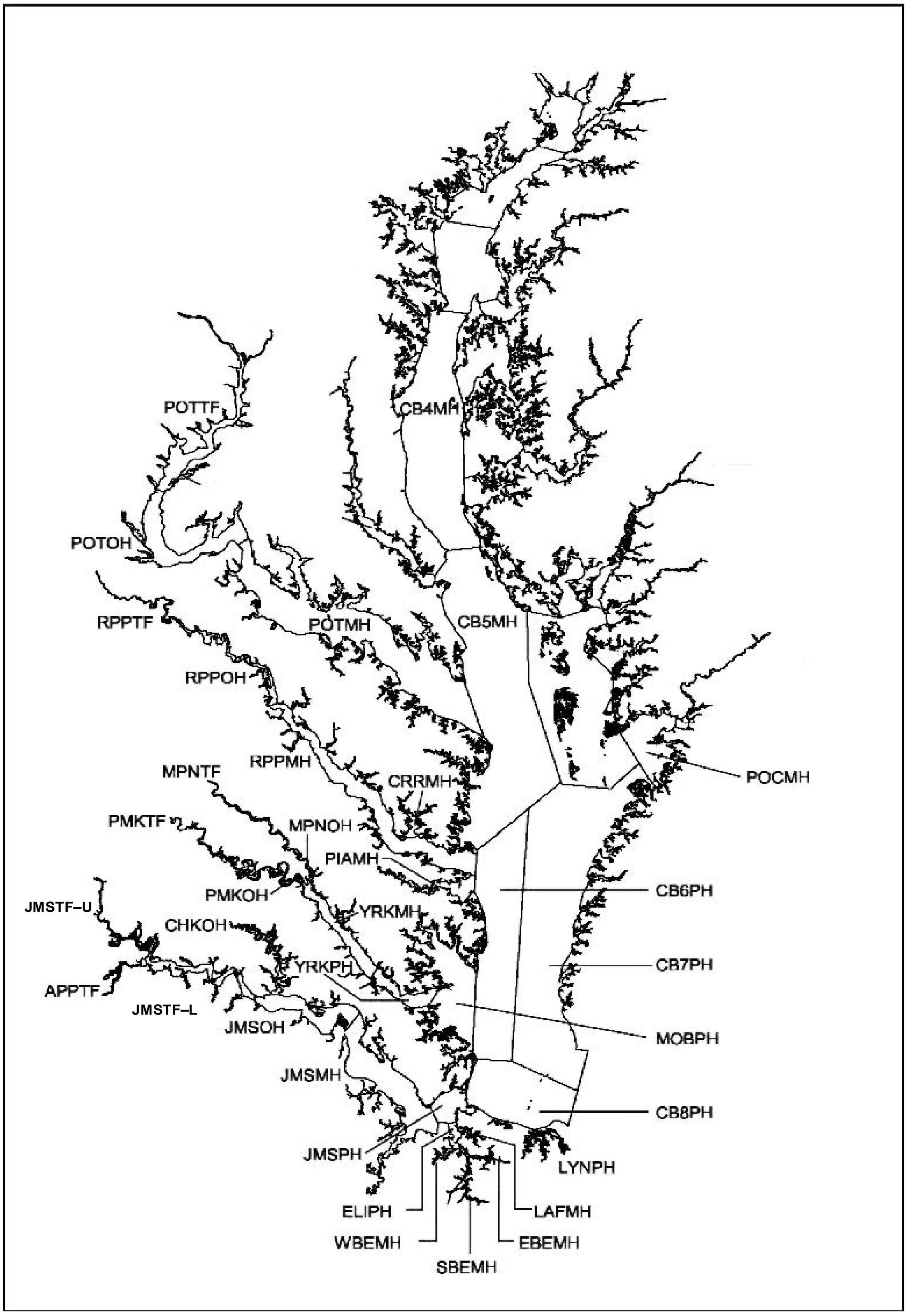
Table 6.7-2. Summary of Chesapeake Bay water clarity criteria for application to shallow-water bay grass designated use habitats. Chesapeake Bay program segments are shown if Figure 6.7-2.

Chesapeake Bay Program Segment	SAV Acres[1]	Water Clarity Criteria (percent light-through-water)[2]	Water Clarity Acres[1]	Temporal Application
CB5MH	7,633	22%	14,514	April 1 - October 31
CB6PH	1,267	22%	3,168	March 1 - November 30
CB7PH	15,107	22%	34,085	March 1 - November 30
CB8PH	11	22%	28	March 1 - November 30
POTTF	2,093	13%	5,233	April 1 - October 31
POTOH	1,503	13%	3,758	April 1 - October 31
POTMH	4,250	22%	10,625	April 1 - October 31
RPPTF	66	13%	165	April 1 - October 31
RPPOH	0	-	0	-
RPPMH	1700	22%	5000	April 1 - October 31
CRRMH	768	22%	1,920	April 1 - October 31
PIAMH	3,479	22%	8,014	April 1 - October 31
MPNTF	85	13%	213	April 1 - October 31
MPNOH	0	-	0	-
PMKTF	187	13%	468	April 1 - October 31
PMKOH	0	-	0	-
YRKMH	239	22%	598	April 1 - October 31
YRKPH	2,793	22%	6,982	March 1 - November 30
MOBPH	15,901	22%	33,990	March 1 - November 30
JMSTF2	200	13%	500	April 1 - October 31
JMSTF1	1000	13%	2500	April 1 - October 31
APPTF	379	13%	948	April 1 - October 31
JMSOH	15	13%	38	April 1 - October 31
CHKOH	535	13%	1,338	April 1 - October 31
JMSMH	200	22%	500	April 1 - October 31
JMSPH	300	22%	750	March 1 - November 30
WBEMH	0	-	0	-
SBEMH	0	-	0	-
EBEMH	0	-	0	-
LAFMH	0	-	0	-
ELIPH	0	-	0	-
LYNPH	107	22%	268	March 1 - November 30
POCOH	0	-	0	-
POCMH	4,066	22%	9,368	April 1 - October 31
TANMH	13,579	22%	22,064	April 1 - October 31

1 = The assessment period for SAV and water clarity acres shall be the single best year in the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the most recent five years shall be used.

2 = Percent Light through Water = $100e^{(-K_dZ)}$ where K_d is water column light attenuation coefficient and can be measured directly or converted from a measured secchi depth where K_d = 1.45/secchi depth. Z = depth at location of measurement of K_d.

Figure 6.7-2) Chesapeake Bay dissolved oxygen and water clarity assessment segmentation.



2) 2006 Chesapeake Bay Aquatic Life Use Assessment Results

Dissolved Oxygen Criteria Assessment:

Figure 6.7-3 shows attainment of the 30-day mean criterion for dissolved oxygen in the "Open Water" designated use during the summer time period. Failure of the criteria was observed in the majority of segments. Full attainment of the criteria was achieved in the most upriver portions of the James (JMSTFU), Appomattox (APPTF), Rappahannock (RPPTF, RPPOH), and Potomac Rivers (POTTF). Full attainment of the criteria was also achieved about 35% of the mainstem Bay (i.e. segments CB5PH and CB8PH, and Pocomoke sound (POCMH, POCOH) as well as several other smaller areas (i.e. Lower James (JMSPH) and Piankatank River (PIAMH)).

The highest violation rate was observed in the Southern Branch of the Elizabeth River (SBEMH), with a 75% criteria exceedance rate. Several large segments had a very low exceedance rate (e.g. Bay mainstem segment CB6PH had only .66% criteria exceedance and the middle James River (JMSOH) had only .06% exceedance) The high rate of failure in the Mattaponi (MPNTF, MPNOH) and Pamunkey (PMKTF, PMKOH) rivers is because the criteria used are inappropriate due to the natural influence of extensive wetlands (see footnote 1 of Table 6.7-1). It is expected that that the rate of failure will be greatly reduced when the appropriate criteria are reported 2008. These special criteria were not adopted until January 12, 2006 and therefore there was insufficient time to include these in this 2006 assessment.

Figure 6.7-4 shows attainment of the 30-day mean criterion for dissolved oxygen in the "Open Water" designated use during the non-summer time period. Somewhat surprisingly, several smaller systems still fail this criterion during the cooler months (i.e. Lynnhaven River (LYNMH), Southern Branch Elizabeth (SBEMH), Tidal Fresh Pocomoke River (POCTF), and the oligohaline portion of the Mattaponi River (MPNOH).

Figure 6.7-5 shows attainment of the 30-day mean criterion for dissolved oxygen in the "Deep Water Aquatic Life" designated use. The "Deep Water" criteria is attained in two areas (i.e. part of mainstem Chesapeake Bay and the mouth of the York River) and failed in four areas segments (i.e. parts of mainstem Chesapeake Bay, mouth of the Rappahannock River, Southern branch of the Elizabeth River, and some Potomac embayments).

Figure 6.7-3) Attainment of Open Water Dissolved Oxygen Criteria in summer months.

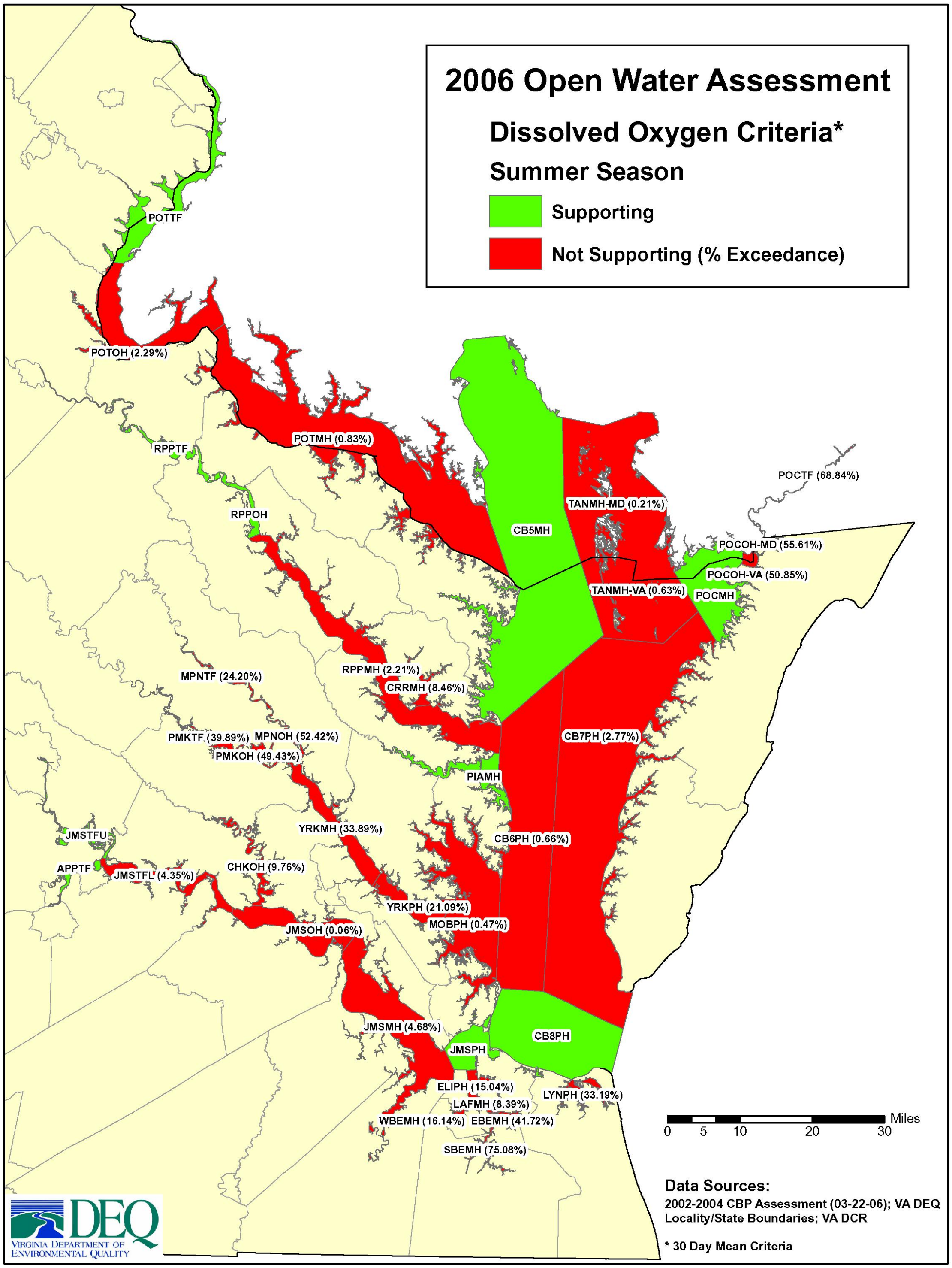


Figure 6.7-4) Attainment of Open Water Dissolved Oxygen Criteria in non-summer months.

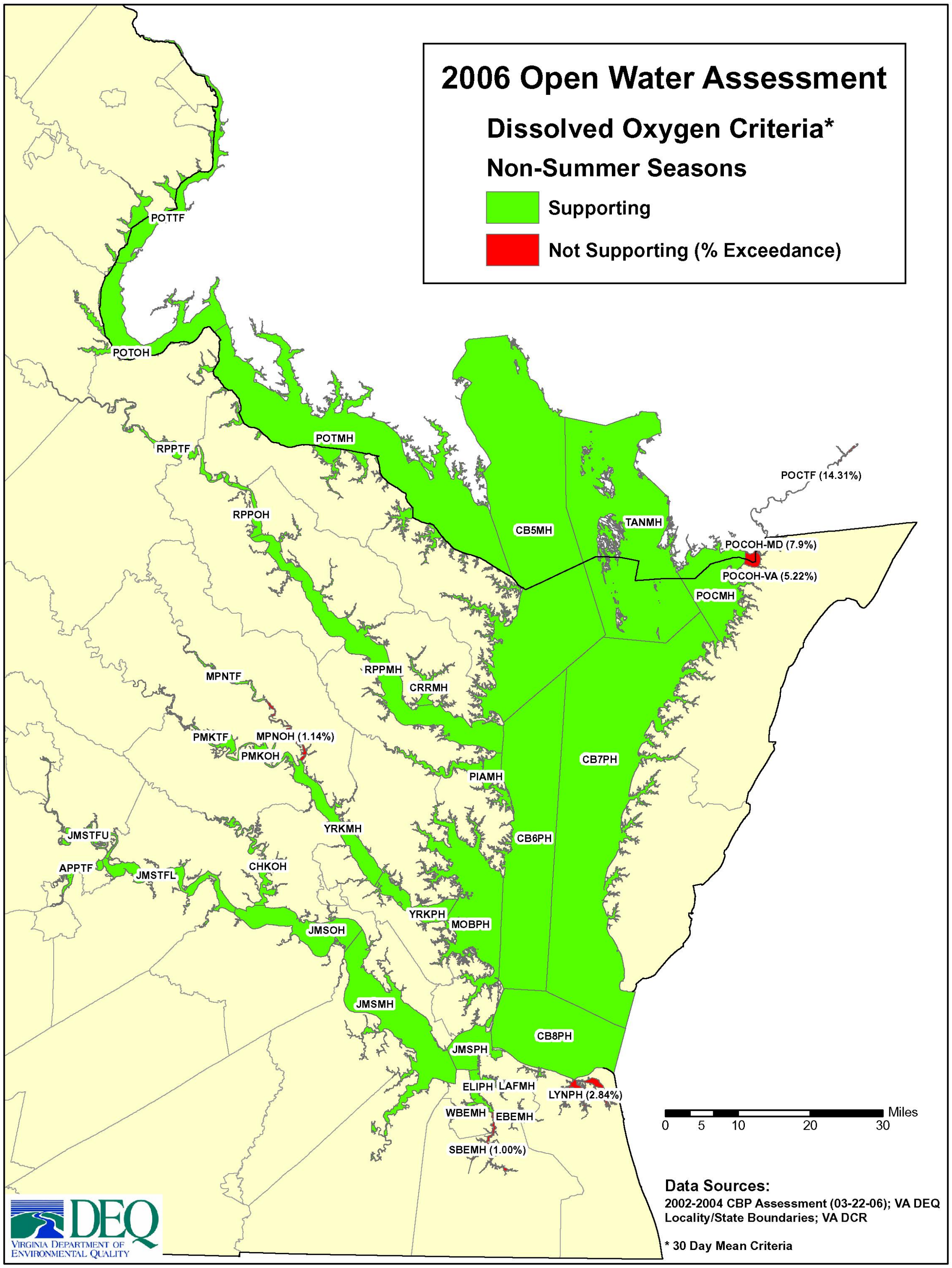
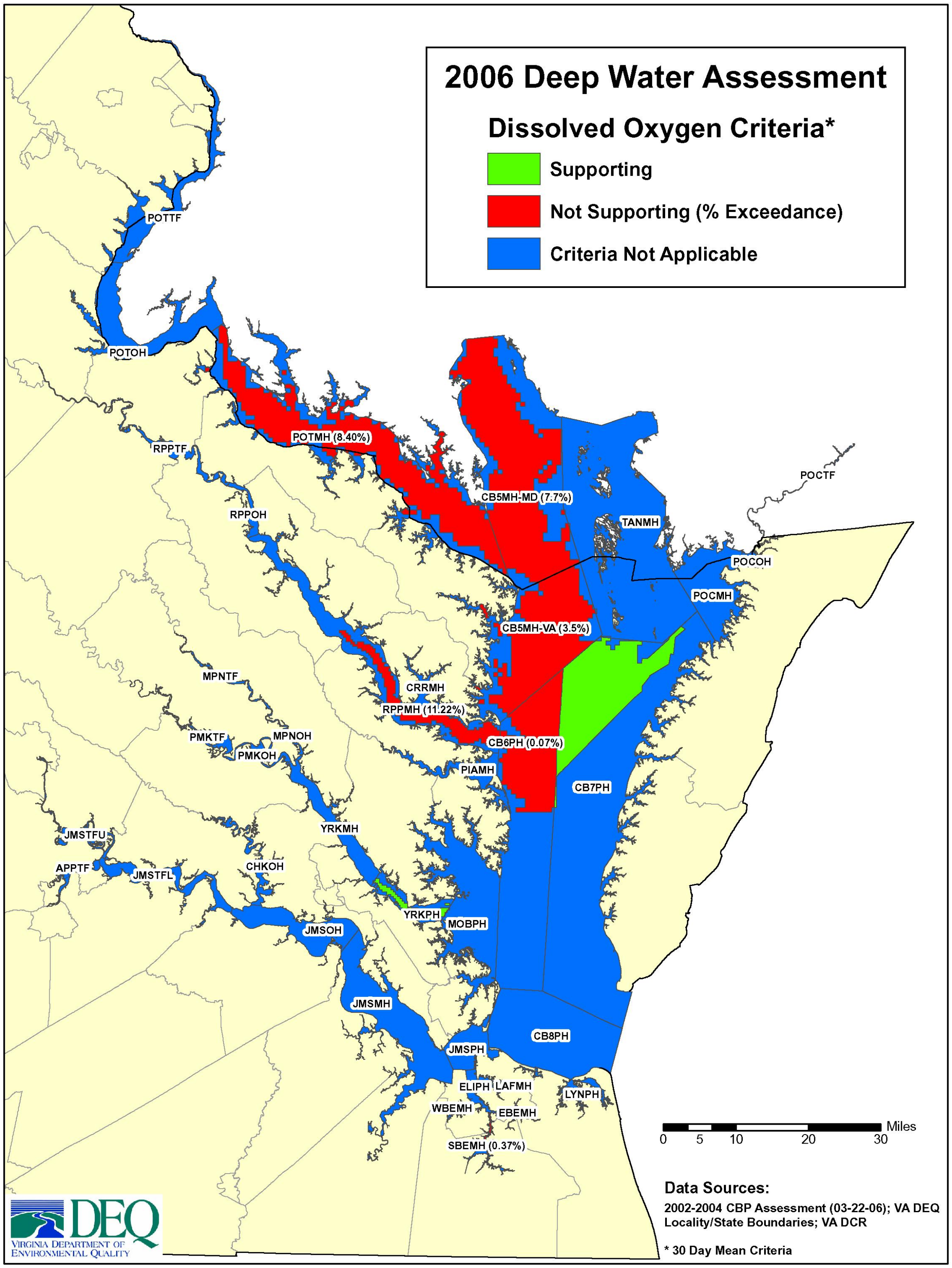


Figure 6.7-5) Attainment of Deep Water Dissolved Oxygen Criteria in the summer months.

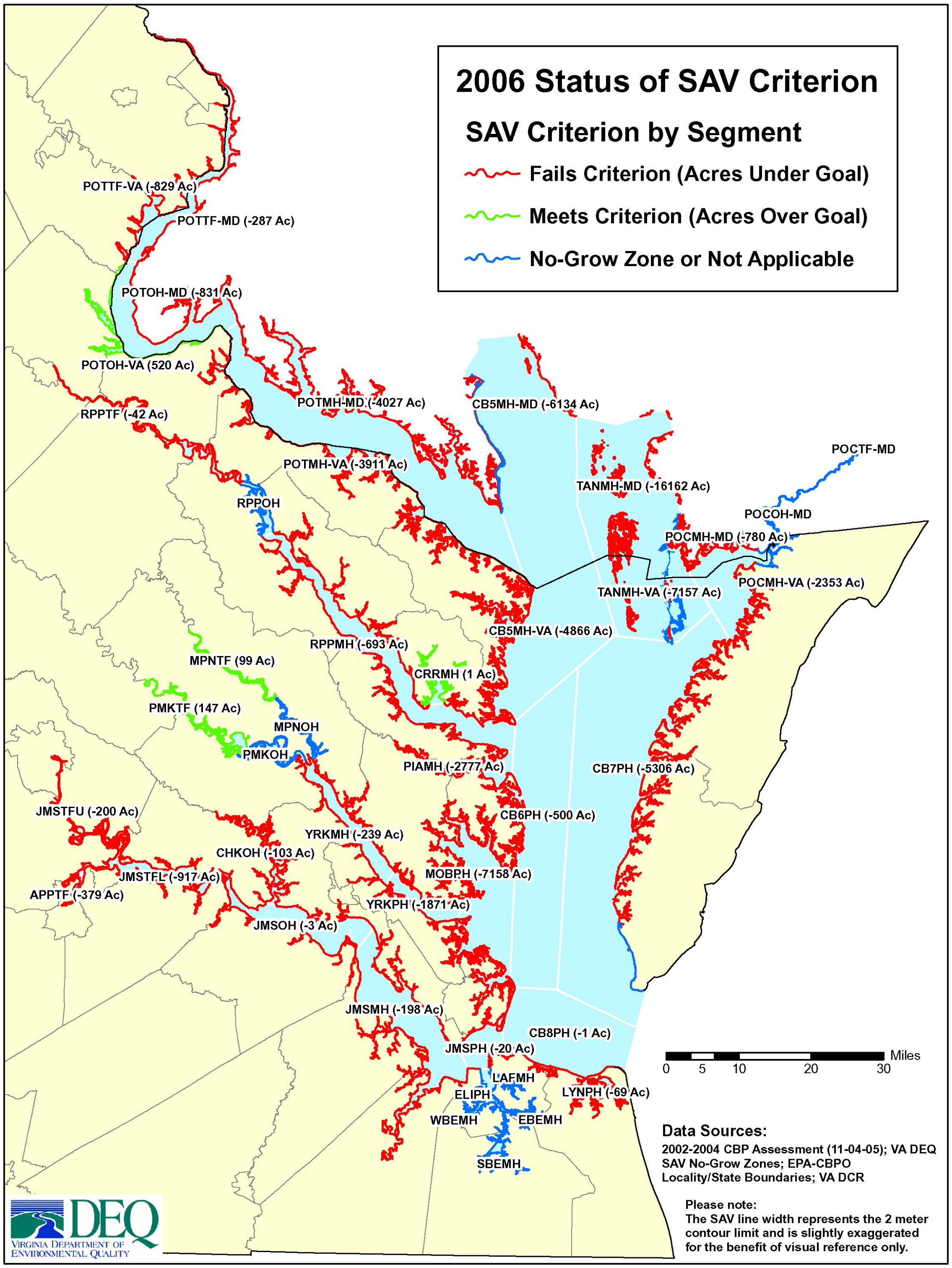


***Water Clarity Criteria Assessment**:*

Figure 6.7-6 shows an evaluation of where the water clarity criteria are attained based upon an analysis of acres of mapped aquatic vegetation. The other criteria of percent-light-through-water can not be assessed at this time due to data availability limitations but should be able to be assessed for the York River system in the 2008 assessment.

Full attainment of the SAV criteria is present in the Corrotoman (CRRMH), middle Potomac (POTOH-VA) and upper Mattaponi (MPNTF), and Pamunkey (PMKTF) rivers. These areas historically have relatively little SAV habitat. The largest shortfall of vegetation occurs in the large open Bay water areas with a combined shortfall of 26,840 acres for segments CB5-VA, TANMH-VA, POCMH-VA, CB7PH, and MOBPH. The overall shortfall of SAV acres is 51% of the criteria (i.e. only 49% of the goal has been reached). This represents 39,560 Acres of SAV which must be restored before this designated use will be met.

Figure 6.7-6) Attainment of SAV Restoration.



Estuarine Bioassessment

A project to assess benthic community health was performed in cooperation among environmental staff from offices of EPA Region III, EPA Chesapeake Bay Program, Maryland Department of the Environment, Maryland Department of Natural Resources and the Virginia Department of Environmental Quality. The project examined Chesapeake Bay program benthic monitoring data collected during the 5 year time period of 2000 – 2004 with the goal of determining attainment of the MD and VA standards for Aquatic Life Use (ALUS). This section describes the assessment protocol and summarizes the key results. Complete technical details are available in "2006 303(D) Assessment Methods For Chesapeake Bay Benthos, Final Report Submitted to Virginia Department of Environmental Quality, Roberto J. Llansó, Jon H. Vølstad, Versar Inc., Daniel M. Dauer, Michael F. Lane, Old Dominion University, September 2005".

Protocol

The overall assessment decision protocol is conducted in three phases as shown in Figure 6.7-7. Phase I consists of the evaluation of the sample size available from the assessment segment during the five-year assessment window. If the sample size requirement is not met, an impairment assessment based on benthic community health is not possible but the data may still be useful as an adjunct to other available aquatic life use data. If the sample size satisfies the requirements of the statistical method (N ≥ 10), a formal assessment of status (i.e. impaired vs. supports aquatic life use) is determined utilizing the "percent degraded area" statistical methodology (Phase II).

Phase II consists of the aquatic life use impairment assessment based on a comparison of Benthic Index of Biotic Integrity (B-IBI) scores and can only be performed when the number of B-IBI scores within a specified waterbody segment is sufficient to meet the sample size requirement of the approved statistical method (N ≥ 10). Phase II can result in one of two possible outcomes: (1) the segment is not impaired for Aquatic Life use due to benthic community status (note that the segment may still be impaired for aquatic life use due to failure of the other aquatic life use subcategories), or (2) the segment fails to support aquatic life use due to benthic community status and is assessed as impaired.

Phase III consists of the identification of probable causes of benthic impairment of the waterbody segment based upon benthic stressor diagnostic analyses. It is a two step procedure that involves (1) Site Classification, and (2) Segment Characterization.

1. Site classification: The first step is to assign probable sources of benthic degradation to each individual "degraded" benthic sample. For the purpose of these diagnostic analyses, a sample is considered degraded if the B-IBI score is less than 2.7.

   Site Classification - Step 1a: The application of a formal statistical linear discriminant function calculates the 'inclusion probability' of each degraded site belonging to a 'contaminant caused' group or an 'other causes' group, based upon its B-IBI score and associated metrics. If a site is assigned to the 'Contaminant' Group with a probability ≥ 0.9, this site is considered impacted by contaminated sediment and no further classification is required.

   Site Classification - Step 1b: If a site is classified as degraded due to 'other causes' (*i.e.*, not contaminant-related), an evaluation of the relative abundance (and/or biomass) of the benthos is examined. Scores for both abundance and biomass are considered to be bipolar for the Chesapeake Bay Benthic IBI. For either metric; a high score of 5, indicating desirable conditions, falls in the mid-range of the abundance/biomass distributions, while a low score of 1, indicating undesirable conditions, can result either from insufficient abundance/biomass or excessive abundance/biomass. The scoring thresholds for these two metrics vary with habitat type (salinity regime and substrate type). In this process, a site is classified as degraded by "low dissolved oxygen" if the abundance (and/or biomass) metric scores a 1 due to insufficient abundance (and/or biomass). Alternatively, if the abundance (and/or biomass) metric scores a 1 because of excessive abundance (and/or biomass) the site is classified as degraded by "eutrophication".

2. Segment classification: The assignment of probable causes of benthic degradation for the overall segment is accomplished using a simple 25% rule. If the percent of total sites in a segment impacted by a single cause (i.e. sediment contaminants, low dissolved oxygen, or eutrophication) exceeds 25%, then that cause is assigned. If no causes exceed 25%, the cause is considered unknown. The cause(s) should be identified as a suspected (vs. verified) cause of benthic community degradation in the ADB database.

Table 6.7-3 shows the possible outcome scenarios from the 3 phases of the protocol.

Figure 6.7-7 Estuarine Benthic Bioassessment Protocol (ALUS).

Overall Decision Protocol.

Phase I Sample Size Evaluation		Phase II Impairment Assessment		Phase III Segment Characterization (Identify Probable Causes)
N < 10 ?	Yes →	Insufficient sample size to conduct statistical assessment Optional use of B-IBI scores and diagnostic analyses as adjunct to other available data		
↓ No				
N ≥ 10 ?	Yes →	Apply Degraded Area Statistical method		
		↓		
		Statistics indicate 'not impaired' for benthic aquatic life? Optional use of B-IBI scores and diagnostic analyses in conjunction with other available data		
		↓ No		
		Statistics indicate 'impaired' for benthic aquatic life	Yes →	Apply diagnostic analyses for assignment of suspected cause(s) of degradation

<table>
<tr><td colspan="6">Table 6.7- 3 Outcome scenarios from benthic biological assessment. VERSAR technical Report: 2006 303(D) Assessment Methods For Chesapeake Bay Benthos, Final Report Submitted to: Virginia Department of Environmental Quality, Roberto J. Llansó, Jon H. Vølstad Versar, Inc., Daniel M. Dauer Michael F. Lane, Old Dominion University, September 2005</td></tr>
<tr><td colspan="6">n>=10 - sufficient sample size for assessment</td></tr>
<tr><td colspan="3">Impairment Analysis</td><td colspan="3">Stressor Diagnostic Analyses</td></tr>
<tr><th>Scenario</th><th>CL-L ($P-P_0$) (Table 3 of VERSAR Technical Report)</th><th>Impaired: Degraded Area method? (Table 3 of VERSAR Technical Report)</th><th>Samples with contaminant Posterior Prob. p>= 0.90; % of Total (Table 5 of VERSAR Technical Report)</th><th>Degraded Samples with excessive Abundance/Biomass; % of Total w/o Cont. (Table 5 of VERSAR Technical Report)</th><th>Degraded Samples with Insufficient Abundance/Biomass ; % of Total w/o Cont. (Table 5 of VERSAR Technical Report)</th></tr>
<tr><td>1</td><td>≤0</td><td>No</td><td>review as supplemental info</td><td>review as supplemental info</td><td>review as supplemental info</td></tr>
<tr><td colspan="6">• A small, non-significant fraction of IBI scores are within or below the lower range of the reference distribution so water quality conditions in this segment support the benthic community (no impairment).
• Where community samples are degraded, the stressor analyses may provide information that supports other assessment data.</td></tr>
<tr><td>2</td><td>>0</td><td>Yes</td><td>≤ 25% of Total Samples</td><td>≤ 25% of Total Samples</td><td>≤ 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses do not suggest dominant stressors affecting community composition. Cause of degradation is “unknown”.</td></tr>
<tr><td>3</td><td>>0</td><td>Yes</td><td>> 25% of Total Samples</td><td>≤ 25% of Total Samples</td><td>≤ 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses suggest sediment contaminants as a likely pollutant affecting benthic community structure.</td></tr>
<tr><td>4</td><td>>0</td><td>Yes</td><td>> 25% of Total Samples</td><td>> 25% of Total Samples</td><td>≤ 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses suggest sediment contaminants as a likely pollutant affecting benthic community structure. Observation of high biomass or abundance is indicative of eutrophic conditions as an additional stressor affecting the benthic community.</td></tr>
<tr><td>5</td><td>>0</td><td>Yes</td><td>> 25% of Total Samples</td><td>≤ 25% of Total Samples</td><td>> 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses suggest sediment contaminants as a likely pollutant affecting benthic community structure. Samples observed with low biomass or abundance are indicative of low dissolved oxygen as an additional stressor affecting the benthic community.</td></tr>
<tr><td>6</td><td>>0</td><td>Yes</td><td>≤ 25% of Total Samples</td><td>> 25% of Total Samples</td><td>≤ 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses do not suggest sediment contaminants as a stressors affecting community composition. Samples observed with high biomass or abundance are indicative of eutrophic conditions (excessive nutrients) as a stressor affecting the benthic community.</td></tr>
<tr><td>7</td><td>>0</td><td>Yes</td><td>≤ 25% of Total Samples</td><td>> 25% of Total Samples</td><td>> 25% of Total Samples</td></tr>
<tr><td colspan="6">• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition).
• Stressor diagnostic analyses do not suggest sediment contaminants as stressor affecting community composition. Samples observed with high biomass or abundance are indicative of eutrophic conditions within the segment while other samples observed with low biomass or abundance are indicative of low dissolved oxygen as another stressor within the segment.</td></tr>
<tr><td>8</td><td>>0</td><td>Yes</td><td>≤ 25% of Total Samples</td><td>≤ 25% of Total Samples</td><td>> 25% of Total Samples</td></tr>
</table>

Table 6.7- 3 Outcome scenarios from benthic biological assessment. VERSAR technical Report: 2006 303(D) Assessment Methods For Chesapeake Bay Benthos, Final Report Submitted to: Virginia Department of Environmental Quality, Roberto J. Llansó, Jon H. Vølstad Versar, Inc., Daniel M. Dauer Michael F. Lane, Old Dominion University, September 2005					
• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition). • Stressor diagnostic analyses do not suggest sediment contaminants as a stressor affecting community composition. Samples observed with low biomass or abundance are indicative of low dissolved oxygen as a stressor affecting the segment.					
9	>0	Yes	> 25% of Total Samples	> 25% of Total Samples	> 25% of Total Samples
• A large, significant fraction of IBI scores are within or below the lower range of the reference distribution, so water quality conditions in this segment do not support the benthic community (impaired condition). • Stressor diagnostic analyses suggest sediment contaminants as a likely pollutant affecting benthic community structure. Samples observed with high biomass or abundance are indicative of eutrophic conditions within the segment while other samples observed with low biomass or abundance are indicative of low dissolved oxygen as an additional stressor within the segment.					
n<10 – small sample size, insufficient for analysis					
1	n/a	Unknown, Not Assessed	review as supplemental info	review as supplemental info	review as supplemental info
• There are too few samples to define the confidence interval of benthic sample IBIs, so in this segment – the biological community condition is unknown. • Where community samples are identified as degraded, information from the stressor diagnostic analyses may provide supplemental information that may support other assessment data.					

Benthic Assessment Results

Table 6.7-4a shows the estuarine benthic bioassessment results. Table 6.7-4b shows the segment ID's and corresponding waterbodies identified in Table 6.7-4a.

Figure 6.7-8 shows a map of the results of this analysis. Approximately 528 square miles of estuarine waters fail the benthic community assessment. This represents 22% of the total assessed square miles. Most of the impairment is in the middle and down-river parts of the tributaries and in the northern part of the Bay mainstem. The up-river parts of the James, Rappahannock, and Pamunkey River as well as most of the bay mainstem attain the benthic community health goals.

The predominant source of benthic community degradation is low dissolved oxygen effecting 1,909 square miles. As expected, this occurs in the upper VA Bay mainstem and middle-lower Rappahannock where low dissolved oxygen problems are worst in the estuarine waters. Another primary source of degradation can not be determined with the analyses performed here (i.e. "unknown" source category) and effects 2,151 square miles. Sediment contaminants are a major source of degradation in the Pagan River, oligohaline portion of the Pamunkey River and tributaries within the Elizabeth River system (i.e. Southern Branch, Eastern Branch, Western Branch and Lynnhaven River).

Table 6.7- 4a) Estuarine Benthic Analysis summarized from results in "2006 303(D) Assessment Methods For Chesapeake Bay Benthos, Final Report Submitted to: Virginia Department of Environmental Quality, Roberto J. Llansó, Jon H. Vølstad - Versar, Inc., Daniel M. Dauer Michael F. Lane - Old Dominion University, September 2005."

Segment	Impaired (Y/N)	Mean B-IBI	Sample Size	% of Total Samples with contaminant Posterior Prob. (*p*>= 0.90)	% of Total Degraded Samples with excessive Abundance/Biomass (w/o Contaminants)	% of Total Degraded Samples with Insufficient Abundance/Biomass (w/o Contaminant)	Suspected Sources of Degradation
LAFMHa	Y (1)	2.4	27	48.15	3.7	3.7	Sediment Contaminants
PMKOHa	Y	2.6	11	27.27	0	9.09	Sediment Contaminants
EBEMHa	Y	2.2	15	60	0	0	Sediment Contaminants
JMSMHb	Y	2.4	16	50	0	0	Sediment Contaminants

Table 6.7- 4a) Estuarine Benthic Analysis summarized from results in "2006 303(D) Assessment Methods For Chesapeake Bay Benthos, Final Report Submitted to: Virginia Department of Environmental Quality, Roberto J. Llansó, Jon H. Vølstad - Versar, Inc., Daniel M. Dauer Michael F. Lane - Old Dominion University, September 2005."

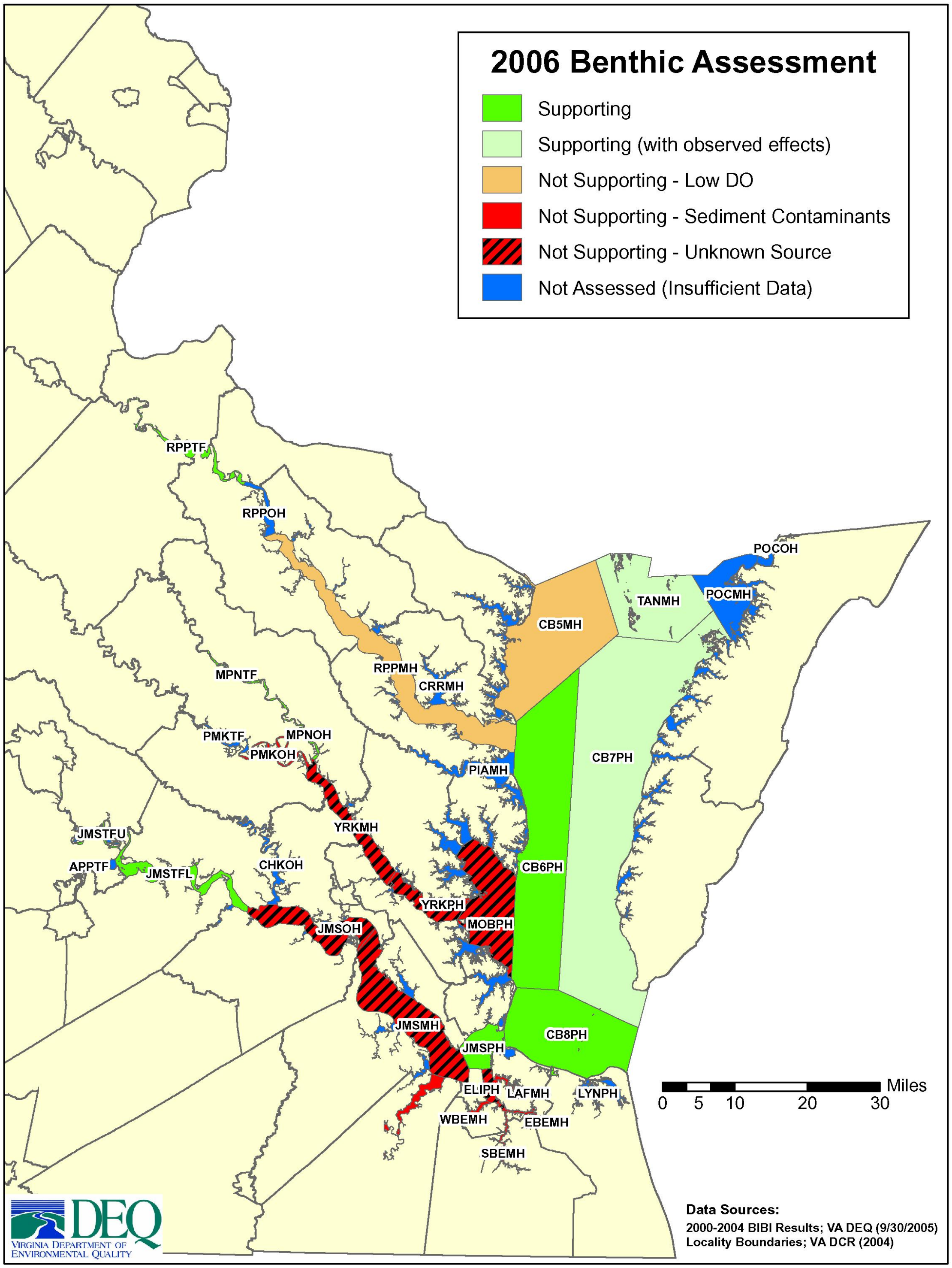
Segment	Impaired (Y/N)	Mean B-IBI	Sample Size	% of Total Samples with contaminant Posterior Prob. (*p*>= 0.90)	% of Total Degraded Samples with excessive Abundance/Biomass (w/o Contaminants)	% of Total Degraded Samples with Insufficient Abundance/Biomass (w/o Contaminant)	Suspected Sources of Degradation
ELIPHa	Y	2.8	17	17.65	5.88	5.88	Unknown
WBEMHa	Y	2.4	19	36.84	5.26	5.26	Sediment Contaminants
MOBPHa	Y	3	20	20	5	10	Unknown
JMSOHa	Y	2.9	22	13.64	0	18.18	Unknown
YRKPHa	Y	3	29	10.34	3.45	10.34	Unknown
ELIMHa	Y	2.5	37	18.92	8.11	13.51	Unknown
CB5MH	Y	2.7	44	4.55	2.27	34.09	Low DO
JMSMHa	Y	2.7	46	17.39	6.52	15.22	Unknown
SBEMHa	Y	2	47	57.45	14.89	12.77	Sediment Contaminants
YRKMHa	Y	2.5	64	25	9.38	9.38	Unknown
POTMH	Y	1.7	91	16.48	2.2	64.84	Low DO
JMSPHa	N	3.4	10	0	0	0	Unknown
MPNOHa	N	2.6	11	36.36	0	0	Sediment Contaminants
RPPTFa	N	3.5	11	18.18	0	0	Unknown
POTTF	N	3.1	12	16.67	0	0	Unknown
MPNTFa	N	3.5	13	0	0	0	Unknown
JMSTFa	N	3.2	14	21.43	0	0	Unknown
CB8PHa	N	3.4	15	0	0	13.33	Unknown
CB6PHa	N	3.3	18	5.56	5.56	11.11	Unknown
CB1TF	N	3.1	19	10.53	10.53	0	Unknown
CB7PHa	N (2)	3.3	43	0	2.33	13.95	Unknown
TANMH	N (2)	3.2	48	2.08	0	10.42	Unknown

1) This Lafayette River segment did not actually "fail" the degraded area statistical test but is considered impaired for benthic communities due to best professional judgment. Close examination of the underlying data revealed a single abnormally low salinity year which affected the degraded area statistical test. The segment has a very low mean IBI score (2.4), is located in a highly urbanized sub-watershed and has a very high percentage of its total area impacted by sediment contaminants (48%). The segment was also determined impaired by a Wilcoxon analysis both during the 2004 assessment data period and the 2006 assessment data period.

2) These segments will be listed as having "observed effects" in the ADB database for Virginia due to failure using the Wilcoxon statistical procedure. As discussed in the VERSAR Technical Report, the Wilcoxon is inappropriate for impairment declarations but does suggest a potential degradation.

Table 6.7- 4b) Segment ID's and corresponding waterbody.	
Segment	**Waterbody**
APPTFa	Appomattox River, Mainstem of APPTF
MPNOHa	Mattaponi River, mainstem of MOBPH
MPNTFa	Mattaponi River, mainstem of MPNTF
CB5MH	Maryland/Virginia mainstem
CB6PHa	Virginia Bay, mainstem of CB6PH
CB7PHa	Virginia Bay, mainstem of CB7PH
CB8PHa	Virginia Bay, mainstem of CB8PH
EBEMHa	Elizabeth River Eastern Branch
ELIMHa	Elizabeth River, mainstem of ELIMH
ELIPHa	Elizabeth River, mainstem of ELIPH
JMSMHa	James River, Mainstem of JMSMHa
JMSMHb	Nansmond River
JMSOHa	James River, mainstem of JMSOHa
JMSPHa	James River, mainstem of JMSPH
POCMH	Pocomoke Sound
POCOH	Pocomoke River
POCTF	Pocomoke River
MPNOHa	Mattaponi River, mainstem of MOBPH
MPNTFa	Mattaponi River, mainstem of MPNTF
PMKOHa	Pamunkey River, Mainstem of PMKOH
SBEMHa	Elizabeth River Southern Branch, mainstem of SBEMH
WBEMHa	Elizabeth River Western Branch, mainstem of WBEMH
JMSTFa	James River, mainstem of JMSTF
LAFMHa	Lafayette River
MOBPHa	Mobjack Bay
TANMH	Tangier Sound
POCMH	Pocomoke Sound
POCOH	Pocomoke River
POCTF	Pocomoke River
RPPMHa	Rappahannock River, mainstem of RPPMH
RPPMHd	Robinson Creek
RPPMHm	Totuskey Creek
RPPOHa	Rappahannock River
RPPTFa	Rappahannock River, mainstem of RPPTF
TANMH	Tangier Sound
YRKMHa	York River, mainstem of YRKMH
YRKMHb	Queen Creek
YRKPHa	York River, mainstem of YRKPH

Figure 6.7-8 Estuarine Benthic Biological Assessment (ALUS)



Chesapeake Bay and Tributaries Aquatic Life Use Listing Methodology:

The 2006 listing methodology is new as a result of newly adopted designated uses. The methodology attempts to attain several goals: maintain continuity with previous listing methodologies; accurately reflect the assessment results of new uses and criteria; and most importantly, protect and restore aquatic life. The listing methodology for the new aquatic life use subcategories has been largely developed through a Water Quality Criteria Assessment Workgroup (CAP) composed of staff from offices of EPA Region III, EPA Chesapeake Bay Program, Maryland Department of the Environment, Maryland Department of Natural Resources and the Virginia Department of Environmental Quality. This CAP workgroup will continue to work through various future modifications as necessary to assure bay-wide consistency. More detail of this workgroups activity can be found on the internet site for the Federal-Interstate Chesapeake Bay Program (http://www.chesapeakebay.net/wqcaw.htm). The main rules for designated use attainment categorization are:

- All applicable dissolved oxygen criteria must be assessed and attained in order for a designated use to be considered as attained (e.g. category 1 or 2).

- If only a sub-set of applicable dissolved oxygen criteria are attained (e.g. only the 30-day mean criteria) but the remaining criteria are un-assessed, the designated use is considered as having insufficient data (category 3).

- If any single criterion for Shallow Water Submerged Aquatic Vegetation (SWSAV) use is met then the designated use is met. For 2006 the only SWSAV criterion assessed is the acres of submerged vegetation present (i.e. “SAV Acres”). The use is not attained if this criterion fails regardless if data is unavailable for assessment of the other criteria (i.e. “Water Clarity Acres). This particular “rule” may be revised in 2008 due to inconsistencies with procedures used by Maryland.

- Waters which were previously listed for Aquatic Life Use (ALUS) as impaired (i.e. category 5) by low dissolved oxygen effects using previous criteria will remain listed as impaired for dissolved oxygen until all new applicable criteria are assessed. This “carry-forward” of previous oxygen impairments will be listed as ALUS impairment (i.e. category 5) and due to dissolved oxygen.

- If any aquatic life use subcategory (i.e. SWSAV, MSN, OW, DW, DC) is not attained (i.e. category 5), then the overall Aquatic life use (i.e. ALUS) is also not attained.

- Assessment of ALUS with the Benthic IBI used a new and more accurate statistical protocol (i.e. % degraded Area) in 2006. The previous protocol (i.e. Stratified Wilcoxon Test) was also performed on the same data. As a conservative approach, a segment which passed the new statistical analysis but failed the older method previously used will be listed as having an “observed effect”. This notation of “observed effects” will remain until the waterbody has passed the new statistical procedure for two consecutive reporting periods.

Overall Aquatic Life Use Assessment and Listing Results:

Table 6.7-5 presents aquatic life designated uses support summary for the Chesapeake Bay and its tidal tributaries. A total of 2,161 sq. miles (99.9% of the total area) of the Bay and tributaries does not support the aquatic life use. The Open Water Aquatic Life is the use subcategory with the largest area of non-attainment and thus is the largest contributor to the overall aquatic life use non-attainment. The second largest subcategory is Deep Water aquatic life use (314 sq. miles of non-attainment). The smallest area of designated use non-attainment is for Shallow Water Submerged Aquatic vegetation (61 sq. miles of non-attainment). Some designated uses (i.e. Migratory Fish Spawning and Deep Channel Refuge) were not assessed in 2006 for reasons explained in the next section of this report.

Table 6.7-6 presents the cause (i.e. the specific impairment) for non-attainment of the various designated uses. The majority of the impairment is due to dissolve oxygen depletion (1858 square miles). Previous assessment reports suggested that the areas of dissolved oxygen impairment were generally limited to areas in deeper waters related to natural water column stratification. A somewhat surprising result of the new assessment process is that this does not seem to be the case and in fact many areas (1,632 square miles) of generally more shallow waters (i.e. the Open Water Aquatic Life Use) also have impaired conditions for dissolved oxygen. The second largest cause for impairment is biological integrity assessments based upon analysis of the benthic macroinvertebrate community. A total of 627 sq. miles are impaired because of this. About half of the benthic community impairments are caused by low dissolved oxygen, a small area is caused by sediment contaminants, and the remainder is due to “unknown” causes (see Figure 6.7-8). The third cause of impairment is lack of sufficient Submerged Aquatic Vegetation. This lack of Submerged Aquatic Vegetation has been generally attributed to historical overall declines in water clarity throughout the Chesapeake Bay and tributaries.

Table 6.7- 5 (Units: SQUARE MILES)

Designated Use	Total Size Assessed	Size Fully Supporting	Size Not Supporting	Size Not Assessed	Size with Insufficient Info
Aquatic Life Use	2,162	0	2,161	0	1
Migratory Fish Spawning and Nursery Aquatic Life	0	0	0	351	0
Shallow Water Submerged Aquatic Vegetation	121	60	61	0	0
Open Water Aquatic Life	2,162	0	1,632	0	530
Deep Water Aquatic Life	469	0	314	0	155
Deep-Channel Seasonal Refuge	0	0	0	146	0

Table 6.7- 6 (Units: SQUARE MILES)

Impairment	Total Size
BIOLOGIC INTEGRITY (BIOASSESSMENTS)	627
AQUATIC PLANTS (MACROPHYTES)	61
OXYGEN DEPLETION	1,858

Table 6.7-7 shows the designated uses, detailed criteria assessment results and listing category for each CBP program segment.

Legend

Data Assessment Results

Cell Shading	Analysis Result
	Criteria Not Applicable
	Criteria Not Assessed
	Insufficient Data to Assess Criteria
	Attainment of Criteria
	Non-Attainment of Criteria

Use Category

Use Category	Description
5A	The water quality standard is not attained. The AU is impaired for one or more designated uses by a pollutant(s) and requires a TMDL (303d list).
3B	Some data exists but is insufficient to determine attainment of designated uses.

Miscellaneous

ALUS: Aquatic Life Use
DW: Deep Water Aquatic Life Use
OW: Open Water Aquatic Life Use
SWSAV: Shallow Water Aquatic Life Use
Summer: Summer Time assessment period
ROY: Non-Summer "Rest of Year" assessment period
30D: 30- Day Dissolved Oxygen Criterion
7D: 7- Day Dissolved Oxygen Criterion
1D: 1 Day Mean Dissolved Oxygen Criterion
IM: Instantaneous Minimum Dissolved Oxygen Criterion

Table 6.7-7 303d listing for each waterbody segment and designated use

			Data Assessment Results								303(d) Listing		
			Dissolved Oxygen					Water Clarity		Benthos			
Bay Segment	Designated Use	Time Period	30D	7D	1D	IM	Special Sturgeon	SAV Acres	WC Acres	IBI	303(d) Listing Decision	Impairments	Use Category
APPTF	ALUS										Fails	Aquatic Vegetation	5A
APPTF	MSN										Insufficient Data		3B
APPTF	OW	ROY									Insufficient Data		3B
APPTF	OW	Summer											3B
APPTF	SWSAV										Fails	Aquatic Vegetation	5A
CB5MH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen, Benthic Community	5A
CB5MH	DC	Summer									Not Assessed		3B
CB5MH	DW	Summer									Fails	Dissolved Oxygen	5A
CB5MH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
CB5MH	OW	Summer									Insufficient Data - Previously Listed	Previously Listed	5A
CB5MH	SWSAV										Fails	Aquatic Vegetation	5A
CB6PH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
CB6PH	DW	Summer									Fails	Dissolved Oxygen	5A
CB6PH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
CB6PH	OW	Summer									Fails	Dissolved Oxygen	5A
CB6PH	SWSAV										Fails	Aquatic Vegetation	5A
CB7PH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
CB7PH	DW	Summer									Insufficient Data - Previously Listed	Previously Listed	5A
CB7PH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
CB7PH	OW	Summer									Fails	Dissolved Oxygen	5A
CB7PH	SWSAV										Fails	Aquatic Vegetation	5A
CB8PH	ALUS										Fails	Aquatic Vegetation	5A
CB8PH	OW	ROY									Insufficient Data		3B

Table 6.7-7 303d listing for each waterbody segment and designated use

			Data Assessment Results								303(d) Listing		
			Dissolved Oxygen					Water Clarity		Benthos			
Bay Segment	Designated Use	Time Period	30D	7D	1D	IM	Special Sturgeon	SAV Acres	WC Acres	IBI	303(d) Listing Decision	Impairments	Use Category
CB8PH	OW	Summer									Insufficient Data		3B
CB8PH	SWSAV										Fails	Aquatic Vegetation	5A
CHKOH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
CHKOH	MSN										Insufficient Data		3B
CHKOH	OW	ROY									Insufficient Data		3B
CHKOH	OW	Summer									Fails	Dissolved Oxygen	5A
CHKOH	SWSAV										Fails	Aquatic Vegetation	5A
CRRMH	ALUS										Fails	Dissolved Oxygen	5A
CRRMH	MSN										Insufficient Data		3B
CRRMH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
CRRMH	OW	Summer									Fails	Dissolved Oxygen	5A
CRRMH	SWSAV										Meets		2
EBEMH	ALUS										Fails	Dissolved Oxygen, Benthic Community	5A
EBEMH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
EBEMH	OW	Summer									Fails	Dissolved Oxygen	5A
ELIPH	ALUS										Fails	Dissolved Oxygen, Benthic Community	5A
ELIPH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
ELIPH	OW	Summer									Fails	Dissolved Oxygen	5A
JMSMH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen, Benthic Community	5A
JMSMH	MSN										Insufficient Data		3B
JMSMH	OW	ROY									Insufficient Data		3B
JMSMH	OW	Summer									Fails	Dissolved Oxygen	5A
JMSMH	SWSAV										Fails	Aquatic Vegetation	5A
JMSOH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen, Benthic Community	5A
JMSOH	MSN										Insufficient Data		3B
JMSOH	OW	ROY									Insufficient Data		3B
JMSOH	OW	Summer									Fails	Dissolved Oxygen	5A
JMSOH	SWSAV										Fails	Aquatic Vegetation	5A
JMSPH	ALUS										Fails	Aquatic Vegetation	5A
JMSPH	OW	ROY									Insufficient Data		3B
JMSPH	OW	Summer									Insufficient Data		3B
JMSPH	SWSAV										Fails	Aquatic Vegetation	5A
JMSTF1 – Lower	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
JMSTF1 – Lower	MSN										Insufficient Data		3B
JMSTF1 – Lower	OW	ROY									Insufficient Data		3B
JMSTF1 – Lower	OW	Summer									Fails	Dissolved Oxygen	5A
JMSTF1 – Lower	SWSAV										Fails	Aquatic Vegetation	5A
JMSTF2 – Upper	ALUS										Fails	Aquatic Vegetation	5A
JMSTF2 – Upper	MSN										Insufficient Data		3B

Table 6.7-7 303d listing for each waterbody segment and designated use

			Data Assessment Results								303(d) Listing		
			Dissolved Oxygen					Water Clarity		Benthos			
Bay Segment	Designated Use	Time Period	30D	7D	1D	IM	Special Sturgeon	SAV Acres	WC Acres	IBI	303(d) Listing Decision	Impairments	Use Category
JMSTF2 – Upper	OW	ROY									Insufficient Data		3B
JMSTF2 – Upper	OW	Summer									Insufficient Data		3B
JMSTF2 – Upper	SWSAV										Fails	Aquatic Vegetation	5A
LAFMH	ALUS										Fails	Dissolved Oxygen, Benthic Community	5A
LAFMH	OW	ROY									Insufficient Data		3B
LAFMH	OW	Summer									Fails	Dissolved Oxygen	5A
LYNPH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
LYNPH	OW	ROY									Fails	Dissolved Oxygen	5A
LYNPH	OW	Summer									Fails	Dissolved Oxygen	5A
LYNPH	SWSAV										Fails	Aquatic Vegetation	5A
MOBPH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
MOBPH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
MOBPH	OW	Summer									Fails	Dissolved Oxygen	5A
MOBPH	SWSAV										Fails	Aquatic Vegetation	5A
MPNOH	ALUS										Fails	Dissolved Oxygen	5A
MPNOH	MSN										Insufficient Data		3B
MPNOH	OW	ROY									Fails	Dissolved Oxygen	5A
MPNOH	OW	Summer									Fails	Dissolved Oxygen	5A
MPNTF	ALUS										Fails	Dissolved Oxygen	5A
MPNTF	MSN										Insufficient Data		3B
MPNTF	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
MPNTF	OW	Summer									Fails	Dissolved Oxygen	5A
MPNTF	SWSAV										Meets		2
PIAMH	ALUS										Fails	Aquatic Vegetation	5A
PIAMH	MSN										Insufficient Data		3B
PIAMH	OW	ROY									Insufficient Data		3B
PIAMH	OW	Summer									Insufficient Data		3B
PIAMH	SWSAV										Fails	Aquatic Vegetation	5A
PMKOH	ALUS										Fails	Dissolved Oxygen	5A
PMKOH	MSN										Insufficient Data		3B
PMKOH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
PMKOH	OW	Summer									Fails	Dissolved Oxygen	5A
PMKTF	ALUS										Fails	Dissolved Oxygen	5A
PMKTF	MSN										Insufficient Data		3B
PMKTF	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
PMKTF	OW	Summer									Fails	Dissolved Oxygen	5A
PMKTF	SWSAV										Meets		2
POCMH	ALUS										Fails	Aquatic Vegetation	5A
POCMH	MSN										Insufficient Data		3B
POCMH	OW	ROY									Insufficient Data		3B
POCMH	OW	Summer									Insufficient Data		3B
POCMH	SWSAV										Fails	Aquatic Vegetation	5A
POCOH	ALUS										Fails	Dissolved Oxygen	5A
POCOH	MSN										Insufficient Data		3B

Table 6.7-7 303d listing for each waterbody segment and designated use														
			Data Assessment Results								303(d) Listing		
			Dissolved Oxygen					Water Clarity		Benthos			
Bay Segment	Designated Use	Time Period	30D	7D	1D	IM	Special Sturgeon	SAV Acres	WC Acres	IBI	303(d) Listing Decision	Impairments	Use Category
POCOH	OW	ROY									Fails	Dissolved Oxygen	5A
POCOH	OW	Summer									Fails	Dissolved Oxygen	5A
POTMH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
POTMH	DC	Summer									Not Assessed		3B
POTMH	DW	Summer									Fails	Dissolved Oxygen	5A
POTMH	MSN										Insufficient Data		3B
POTMH	OW	ROY									Insufficient Data		3B
POTMH	OW	Summer									Fails	Dissolved Oxygen	5A
POTMH	SWSAV										Fails	Aquatic Vegetation	5A
POTOH	ALUS										Fails	Dissolved Oxygen	5A
POTOH	MSN										Insufficient Data		3B
POTOH	OW	ROY									Insufficient Data		3B
POTOH	OW	Summer									Fails	Dissolved Oxygen	5A
POTOH	SWSAV										Meets		2
POTTF	ALUS										Fails	Aquatic Vegetation	5A
POTTF	MSN										Insufficient Data		3B
POTTF	OW	ROY									Insufficient Data		3B
POTTF	OW	Summer									Insufficient Data		3B
POTTF	SWSAV										Fails	Aquatic Vegetation	5A
RPPMH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen, Benthic Community	5A
RPPMH	DC	Summer									Not Assessed		3B
RPPMH	DW	Summer									Fails	Dissolved Oxygen	5A
RPPMH	MSN										Insufficient Data		3B
RPPMH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
RPPMH	OW	Summer									Fails	Dissolved Oxygen	5A
RPPMH	SWSAV										Fails	Aquatic Vegetation	5A
RPPOH	ALUS												3B
RPPOH	MSN										Insufficient Data		3B
RPPOH	OW	ROY									Insufficient Data		3B
RPPOH	OW	Summer									Insufficient Data		3B
RPPTF	ALUS										Fails	Aquatic Vegetation	5A
RPPTF	MSN										Insufficient Data		3B
RPPTF	OW	ROY									Insufficient Data		3B
RPPTF	OW	Summer									Insufficient Data		3B
RPPTF	SWSAV										Fails	Aquatic Vegetation	5A
SBEMH	ALUS										Fails	Dissolved Oxygen	5A
SBEMH	DW	Summer									Fails	Dissolved Oxygen	5A
SBEMH	OW	ROY									Fails	Dissolved Oxygen	5A
SBEMH	OW	Summer									Fails	Dissolved Oxygen	5A
TANMH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen	5A
TANMH	OW	ROY									Insufficient Data		3B
TANMH	OW	Summer									Fails	Dissolved Oxygen	5A
TANMH	SWSAV										Fails	Aquatic Vegetation	5A
WBEMH	ALUS										Fails	Dissolved Oxygen, Benthic Community	5A
WBEMH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
WBEMH	OW	Summer									Fails	Dissolved Oxygen	5A
YRKMH	ALUS										Fails	Aquatic Vegetation,	5A

Table 6.7-7 303d listing for each waterbody segment and designated use

			Data Assessment Results								303(d) Listing		
			Dissolved Oxygen					Water Clarity		Benthos			
Bay Segment	Designated Use	Time Period	30D	7D	1D	IM	Special Sturgeon	SAV Acres	WC Acres	IBI	303(d) Listing Decision	Impairments	Use Category
												Dissolved Oxygen, Benthic Community	
YRKMH	MSN										Insufficient Data		3B
YRKMH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
YRKMH	OW	Summer									Fails	Dissolved Oxygen	5A
YRKMH	SWSAV										Fails	Aquatic Vegetation	5A
YRKPH	ALUS										Fails	Aquatic Vegetation, Dissolved Oxygen, Benthic Community	5A
YRKPH	DW	Summer									Insufficient Data - Previously Listed	Previously Listed	5A
YRKPH	OW	ROY									Insufficient Data - Previously Listed	Previously Listed	5A
YRKPH	OW	Summer									Fails	Dissolved Oxygen	5A
YRKPH	SWSAV										Fails	Aquatic Vegetation	5A

3) Plans for future assessment refinements

This 2006 assessment report is the first report which examined newly developed designated uses in the Chesapeake Bay and its tidal tributaries. We believe that much progress has been made in developing realistic and appropriate designated uses and associated criteria. However, this 2006 assessment is a transitional assessment because there are some refinements planned for future assessments as well as issues that arose during the implementation of new assessment protocols. Not all future changes can be predicted at this time but possible refinements for future assessments are summarized below. To assure consistency throughout the multi-State Chesapeake Bay system, most of these issues will be resolved through the a Water Quality Criteria Assessment Workgroup (CAP) composed of staff from offices of EPA Region III, EPA Chesapeake Bay Program, Maryland Department of the Environment, Maryland Department of Natural Resources and the Virginia Department of Environmental Quality.

- *Assessment of un-assessed designated uses and criteria*.

Of the five new designated uses, this 2006 report only reports on conditions for "Open Water", "Deep Water", and Shallow Water SAV" aquatic life uses. It is anticipated that future reports will be able to assess the remaining uses of "Deep Channel" and "Migratory and Spawning" aquatic life. Furthermore, only a rather limited suite of criteria for each use were assessed, these being 30-Day average dissolved oxygen criteria and the submerged aquatic vegetation acres criteria. Many other criteria were not assessed (e.g. 7-day, 1-day, and instantaneous minimum criteria for dissolved oxygen and water clarity criterion for Submerged Aquatic Vegetation). These limitations on assessments of designated uses and criteria are due to the lack of available data as well as the needs to finalize data analysis protocols. Also, several criteria will be assessed in 2008 for which data and protocols existed but the criteria were not officially effective until January 12, 2006. These new criteria are for chlorophyll concentration in the James River and also the special dissolved oxygen criteria footnoted in Table 6.7-1 for the Mattaponi and Pamunkey Rivers.

- *Refinements to assessment protocols*

Detailed assessment protocols were published previously (*Water Quality Assessment Guidance Manual for Y2006: 305(B)/303(D) Integrated Water Quality Report*, (December, 2005). While DEQ believes these protocols were sufficiently valid since they were published in EPA guidance, the following issues will be examined in more detail for future assessments.

a. Data used for assessment

For this 2006 assessment DEQ used all available data which included those collected through citizen volunteer monitoring, DEQ ambient monitoring, DEQ coastal 2000 monitoring, the CBP Benthic monitoring, and the CBP Water Quality Monitoring program. While all of these data have been Quality Assured/Quality Controlled as accurate for usage in its original purpose, some may be inappropriate for usage in the Bay criteria assessment because of site selection or timing and frequency of collection. This issue will be examined in more detail in future assessments.

b. Refinements in spatial interpolation tools

Part of the assessment protocol involves spatial interpolation of data to create a 3- dimensional "picture" of oxygen conditions throughout a waterbody segment. The software used for performing this step in this assessment is being refined and updated to allow a more accurate interpolation for future assessments.

c. Refinements in statistical determination of attainment

Data are assessed after interpolation for criteria exceedences using a reference curve to determine waterbody attainment. The 2006 assessment was based on either EPA published reference curves or used a default 10% reference curve if a published one was not available for a specific aquatic life subcategory (e.g. deep water). It is possible that new reference curves developed by EPA, could be adopted into Virginia Water Quality, and used in future assessments. Also, there may be future efforts to explicitly incorporate statistical measures of uncertainty into the attainment process.